

The Degradation of Microorganisms Exposed to Mn(II) and SiO₂ Solutions: Implications for the Preservation of Biosignatures in Manganiferous Deposits

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The experimental degradation of *Escherichia coli* and *Bacillus subtilis* exposed to concentrations of Mn(II) (from 10 ppm to 1000 ppm), and SiO₂ (from 100 ppm to 5000 ppm) was monitored in the laboratory to assess the potential for recovery of biosignatures from ancient manganiferous and siliceous sediments. Specifically, the degradation of phospholipid fatty acids (PLFAs) to *n*-alkanes, DNA perseverance, and persistence of recognizable bacterial morphology was observed over time. DNA was investigated as a short-lived biomarker, while PLFA-derived *n*-alkane molecules were studied as a long-lived biomarker. Results can be used as a guideline in the search for biosignatures in manganiferous sediments.

Preliminary PLFA analysis showed that in solutions containing *E. coli* and SiO₂, PLFAs not observed in control samples were detected after 188 days. *B. subtilis* cells exposed to 1000 ppm Mn(II) solution for 72 days showed complete conversion of PLFAs to *n*-alkanes. Further analysis will determine whether the PLFA to *n*-alkane conversion is a stable terminal effect regardless of Mn(II) concentration. The perseverance of *E. coli* DNA appeared to be enhanced by the presence of SiO₂ solution when compared with extracted DNA in control samples of *E. coli* in DI water. Investigation of DNA degradation of microorganisms exposed to Mn(II) solution are currently in progress. This study attempts to bridge the gap between the modern and ancient, and to provide a means by which to identify biosignatures that will survive over time in ancient manganiferous and siliceous sediments.